

Claims

1. An electrolysis apparatus for the production of hydrogen and oxygen, which apparatus includes at least: -
- 5 two or more tubular electrodes, at least one of which is an inner electrode located in at least one outer electrode; and
a separator interposed between the inner and outer electrodes and substantially coextensive therewith.
- 10 2. An electrolysis apparatus as claimed in claim 1, wherein one or more of the electrodes is, in use, an anode.
3. An electrolysis apparatus as claimed in claim 1, wherein one or more of the electrodes is, in use, a cathode.
- 15 4. An electrolysis apparatus as claimed in any one of the preceding claims, wherein the separator is positioned between the anode and the cathode so that there is substantially no gap between the separator and the anode, and the separator and the cathode.
- 20 5. An electrolysis apparatus as claimed in any one of the preceding claims, wherein a portion of the separator is bonded to a support structure associated with the anode and/or the cathode.
- 25 6. An apparatus as claimed in any one of the preceding claims, wherein the electrodes are made of an apertured conductive material.
7. An apparatus as claimed in any one of the preceding claims, wherein the electrodes are plated with a conductive material.

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8. An apparatus as claimed in any one of the preceding claims, wherein the apertured conductive material is a sintered body having flow channels extending between the inside and the outside thereof.

9. An apparatus as claimed in claim 6 or claim 7, wherein the apertured conductive material is a single layer mesh.

10. An apparatus as claimed in claim 6 or claim 7, wherein the apertured conductive material includes two or more layers of mesh.

11. An apparatus as claimed in claim 6 or claim 7, wherein the apertured conductive material is a three dimensional mesh.

12. An apparatus as claimed in any one of claims 6 to 11, wherein the apertured conductive material includes a conductive polymer.

13. An apparatus as claimed in claim 12, wherein the conductive polymer is coated with a conductive material.

14. An apparatus as claimed in any one of claims 6 to 13, wherein the apertured conductive material comprises of one or more of silver, nickel, stainless steel, and copper.

15. An apparatus as claimed in any one of the preceding claims, wherein the anode and cathode are substantially concentric.

16. An apparatus as claimed in any one of the preceding claims, wherein a plurality of anodes and cathodes of various diameters are nested to provide a high electrolysis surface area to electrolysis apparatus volume ratio.

17. An apparatus as claimed in any one of claims 2, and 4 to 16, wherein the anode comprises one or more layers of stainless steel mesh.

18. An apparatus as claimed in any one of claims 2, and 4 to 17, wherein the anode is nickel plated.

19. An apparatus as claimed in any one of claims 3, and 4 to 16, wherein the cathode is made of one or more layers of stainless steel mesh.

20. An apparatus as claimed in any one of claims 2, 4 to 16, and claim 19, wherein the cathode is nickel plated.

21. An apparatus as claimed in claim 18 or claim 20, wherein the mesh is nickel plated before or after the layers of stainless steel are placed together.

22. An apparatus as claimed in any one of the preceding claims, wherein one or more of the tubular anode and the cathode are closed off at one end such that, in use, an overpressure is established within the closed off tubular electrode.

23. An apparatus as claimed in any one of the preceding claims, wherein one or more conductors are provided in association with the electrodes.

24. An apparatus as claimed in claim 23, wherein a tubular apertured conductor is provided on the outside of the outer electrode and another on the inside of the inner electrode.

25. An apparatus as claimed in claim 23, wherein the conductors are in the form of one or more conductive strips attached to a portion or portions of the electrodes.

26. An apparatus as claimed in any one of the preceding claims, wherein the separator comprises one or more layers of a fibrous material.

5 27. An apparatus as claimed in claim 26, wherein the separator comprises one or more layers of a wettable material.

28. An apparatus as claimed in claim 27, wherein the separator comprises one or more layers of a wettable fibrous material.

10 29. An apparatus as claimed in any one of the preceding claims, wherein the separator comprises one or more layers of cellulose containing composition.

30. An apparatus as claimed in claim 29, wherein the cellulose containing composition is paper.

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31. An apparatus as claimed in claim 30, wherein the paper is a filter paper.

32. An apparatus as claimed in any one of the preceding claims, including :

- a tubular stainless steel mesh anode electrode; and
- 20 - a tubular nickel-plated stainless steel mesh cathode electrode, wherein the cathode and anode are substantially concentric and the cathode lies within the anode

33. An apparatus as claimed in claim 32, including a separator means
25 between the anode and cathode comprising one or more layers of a fibrous material.

34. An apparatus as claimed in claim 33, wherein the fibrous material is a wettable fibrous material.

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35. An apparatus as claimed in any one of the preceding claims which, in use, includes an alkaline electrolyte solution.
36. An apparatus as claimed in any one of claims 1 to 34 which, in use,
5 includes an acidic electrolyte solution..
37. An apparatus as claimed in any one of the preceding claims, including means for supplying and conducting electrical current to the electrodes.
- 10 38. An apparatus as claimed in any one of the preceding claims, including means for drawing off the gasses.
39. An apparatus as claimed in any one of the preceding claims, including means for removing vapour from the generated gasses.
- 15 40. An apparatus as claimed in any one of the preceding claims, wherein a plurality of electrode sets are used in parallel.
41. An apparatus as claimed in any one of the preceding claims, wherein a
20 plurality of electrode sets are used in series.
42. An apparatus as claimed in any one of the preceding claims, wherein a plurality of electrode sets is arranged in a common electrolyte around a tubular conductor that is in contact with each electrode which acts as an anode.
- 25 43. An apparatus as claimed in claim 42, wherein each cathode is connected to its own conductor.
44. A separator for an electrolysis apparatus, which separator is interposed.
30 between the anode and the cathode of the apparatus, said separator comprising one or more layers of fibrous material.

45. A separator as claimed in claim 44, wherein the fibrous material is wettable.

5 46. A separator as claimed in claim 44 or claim 45, wherein the wettable material is a cellulose containing composition.

47. A separator as claimed in any one of claims 44 to 46, wherein the cellulose containing composition is paper.

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48. A separator as claimed in claim 47, wherein the paper is a filter paper.

49. A separator as claimed in claim 48, wherein the filter paper is chemical resistant filter paper.

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50. A separator as claimed in claim 48 or claim 49, wherein the filter paper is a medium to fast grade filter paper.

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51. An electrolysis process carried out in an apparatus as claimed in any one of claims 4 to 43.

52. A process as claimed in claim 51, including:

- establishing a potential difference between the anode and the cathode;
and

25 - contacting the anode and cathode with an electrolyte solution from which gasses are liberated by electrolysis.

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53. A process as claimed in claim 52 or claim 51, including contacting the apparatus with an electrolyte solution of between 10% and 50% by mass of electrolytic salts.

54. A process as claimed in claim 52 or claim 51, including contacting the apparatus with an electrolyte solution of between 20% and 35% by mass of electrolytic salts.

5 55. A process as claimed in any one of claims 52 to 54, wherein the electrolyte solution is a KOH, NaOH, or other alkaline solution.

56. A process claimed in any one of claims 52 to 54, wherein the electrolyte solution is acidic.

10 57. A process as claimed in any one of claims 51 to 56, which process is carried out at a temperature of from 40°C to 100°C.

15 58. A process as claimed in any one of claims 51 to 56, which process is carried out at a temperature of from 60°C to 90°C.

59. A process as claimed in any one of claims 52 to 58, wherein the electrodes are submerged in the electrolyte.

20 60. A process as claimed in any one of claims 52 to 58, wherein the electrolyte is pumped through the separator of the apparatus.

25 61. A process as claimed in any one of claims 52 to 58, wherein the electrolyte is drip fed through the separator, thereby maintaining the separator saturated with electrolyte while minimizing the volume of fluid being circulated.